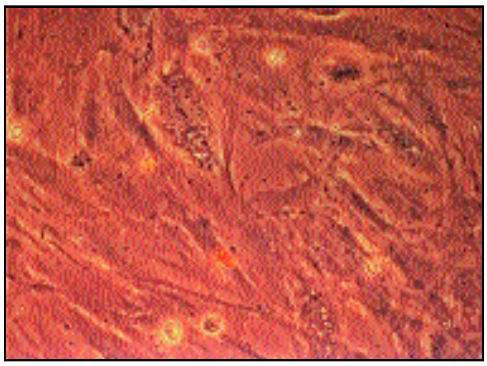
LiSAF LASER FOR CYTOMETERS



● *Compact laser technology can help improve flow cytometry.*

Cell sorters or cytometers have become very sophisticated in a short time in part because of the enormous demand that creative biologists have brought to bear on the industry. Advances in lasers, coupled with newly available dyes and ever-increasing antigen-antibody combinations, have played a large part in widening the range of cell types that can be identified with cytometers.

BMDO HISTORY

A new diode-pumped solid-state lithium strontium aluminum fluoride (LiSAF) laser is being developed by Science and Engineering Services, Inc. (SESI; Burtonsville, MD). It will provide simultaneous output wavelengths of 490 and 980 nanometers. The Q-switched laser is based on a LiSAF crystal, doped with chromium. The short laser pulse durations and solid-state nature of the laser contribute to the system's low power consumption, compactness, and reliability under severe vibrational stress and wide temperature variation. BMDO has provided Phase II funding for this effort, with matching funds provided by the Army and Recon Exploration (Dallas, TX). BMDO has also funded the development of frequency-agile lasers for spaceborne spectroscopic platforms, LIDAR, tracking, detection of atmospheric constituents, and detection of wind shear. SESI has performed research with NASA, the Army, the Navy, and the National Science Foundation in the areas of atmospheric sensing, LIDAR, general laser development, and novel medical instrumentation.

HOW IT WORKS

The laser is tunable within a fundamental range of 780 to 1,000 nanometers and has a high repetition rate (1 to 2 kilohertz) and microjoule pulse capability (50 to 80 microjoules). SESI plans to couple the LiSAF laser system to a flow cytometer to make it more reliable than cytometers operated with non-solid-state, continuous-wave laser outputs. A flow cytometer is a device that uses a laser to detect the fluorescence intensity of cells that flow past a detector in a thin stream. If fluorescence is detected, the cell is given an electrical charge and deflected into a collection bin. The simultaneous output of two different wavelengths can expand a cytometer's ability to sort multiple cell types during one sorting run. By frequency doubling, the second harmonic of the laser can provide blue-green activity, tunable from 390 to 500 nanometers, that would be valuable in the communications

field. A third harmonic bandwidth of 260 to 330 nanometers is possible with further development and would be applicable in ultraviolet flow cytometry. The ultraviolet wavelengths might prove especially useful in lighting up DNA and determining stages in the cell cycle, for example.

MEDICAL SIGNIFICANCE

There is a very large market in biotechnology and medicine for flow cytometers. Among their uses are cell sorting by chromosome content, infective status, antigen presence (as in determination of tissue transplant compatibility), and cell-receptor-ligand combinations. They are used in both research and clinical institutions to analyze a large variety of cell types and can identify cell characteristics through native fluorescence or dye-based illumination strategies.

VENTURES OR PRODUCT AVAILABILITY

SESI is working to commercialize its LiSAF laser and is currently retrofitting a cell sorter manufactured by a well-known flow cytometer supplier.

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